

CONTENTS

Preface	xi
Mahmood F. Mafee	

Preoperative Imaging Anatomy of Nasal-Ethmoid Complex for Functional Endoscopic Sinus Surgery	1
Mahmood F. Mafee	

Endoscopic sinus surgery has become an increasingly popular surgical procedure. Functional endoscopic sinus surgery is based on the hypothesis that the ostiomeatal complex is the key area in the pathogenesis of chronic sinusitis. This article discusses the concept of functional endoscopic sinus surgery, the anatomy of the ostiomeatal complex, and the imaging anatomy of the ostiomeatal complex.

Complications of Endoscopic Sinus Surgery: The Role of the Radiologist in Prevention	21
Patricia A. Hudgins	

Functional endoscopic sinus surgery is a relatively new technique that has gained wide popularity for the management of refractory rhinosinusitis. Virtually all potential surgical candidates undergo a computed tomographic (CT) scan of the paranasal sinuses, which is used to detect lesions obstructing sinus ostia and is referred to by the surgeon during the procedure for correlation of surgical findings and confirmation of location. Normal anatomic variants that may place the patient at increased operative risk may be seen on CT scan. The radiologist, as an integral member of the health care team, must be familiar with these variations and also be comfortable with the radiographic evaluation of a patient who has had a complication of endoscopic sinus surgery.

Chronic Inflammatory Sinonasal Diseases Including Fungal Infections: The Role of Imaging	33
Peter M. Som and Hugh D. Curtin	

The computed tomographic (CT) and magnetic resonance (MR) imaging techniques used for evaluating the paranasal sinuses and nasal fossae are reviewed. A summary of the physics concepts relating to the MR signal

intensities observed with sinonasal secretions is given, as is a review of normal secretions and the pathophysiologic changes in the secretions that occur with chronic infections. The imaging findings of sinonasal chronic infections, mucocles, fungal diseases, and granulomatous diseases are then presented, and a recommended imaging protocol is given.

Manifestations of AIDS in the Oromaxillofacial Region:

The Role of Imaging

Roy A. Holliday

45

A wide range of opportunistic infections, malignancies, and diffuse reactive adenopathy occur in the oromaxillofacial region in patients with the acquired immunodeficiency syndrome (AIDS). The goals of imaging are to assess the extent of disease already identified by the clinician or to detect otherwise occult manifestations of human immunovirus (HIV) infection. The varied manifestations of HIV infection in this region and the indications for imaging are reviewed.

Epithelial Tumors of the Paranasal Sinuses and Nasal Cavity

James M. Chow, John P. Leonetti, and Mahmood F. Mafee

61

This article addresses the various epithelial tumors of the nasal cavity and paranasal sinuses. It emphasizes the radiologic evaluation of patients with these tumors and the radiologic findings of importance. The advantages and disadvantages of the use of computed tomographic (CT) and magnetic resonance (MR) imaging in this evaluation are stressed.

Nonepithelial Tumors of the Paranasal Sinuses and Nasal Cavity:

Role of CT and MR Imaging

Mahmood F. Mafee

75

This article reviews some of the applications of computed tomographic (CT) and magnetic resonance (MR) imaging in the clinical investigation of nonepithelial tumors and tumorlike lesions of the sinonasal tract. Sixty selected patients primarily with various nonepithelial tumors of the sinonasal tract were included in this study. The MR characteristics of many of these lesions are described.

Dental Radiology: Role of Plain Radiographic Examination

Henry M. Rosenberg

91

This article is limited to the radiographic imaging procedures most frequently performed in the practice of dentistry. Intraoral and panoramic radiographic modalities are usually performed by the dentist or under his or her supervision in the dental office. A brief review of dental embryology, morphology, and terminology is also presented.

Imaging of Cysts and Odontogenic Tumors of the Jaw:

Definition and Classification

Alfred L. Weber

101

For the evaluation of jaw cysts and odontogenic tumors, the radiologic examinations include conventional films, computed tomographic (CT) scans, and magnetic resonance (MR) images. The indications for these radiologic methods are discussed along with the radiologic findings for the various cysts and tumors described. The differential diagnosis of these lesions is also included in the discussion.

	Fibro-osseous Lesions of Craniofacial Bones: The Role of Imaging	121
	Hossein Mohammadi-Araghi and Cameron Haery	

Fibro-osseous lesions of the craniofacial structures are a group of pathologic conditions that are somewhat difficult to classify. Fibro-osseous lesions of the jaw may be divided into two categories: fibrous dysplasia, a developmental lesion characterized by the development of swelling, which consists of proliferating fibrous tissue that replaces normal bone; and those that have been postulated to originate from the periodontal ligament. This article describes the imaging characteristics of fibrous dysplasia and other fibro-osseous lesions of oral bones, including ossifying fibroma, periapical cemental dysplasia, cemento-ossifying fibroma, and florid osseous dysplasia.

	Diagnosis of Pathology of the Temporomandibular Joint: Clinical and Imaging Perspectives	135
	Daniel M. Laskin	

The clinical features of the various pathologic conditions involving the temporomandibular joint are described and correlated with their radiographic appearance. Because of the similarities in the radiographic images produced by certain diseases and disorders, emphasis is placed on the need to consider both the clinical and radiographic findings when establishing a diagnosis.

	Imaging of Internal Derangements and Synovial Chondromatosis of the Temporomandibular Joint	149
	Leslie B. Heffez	

Magnetic resonance (MR) imaging of internal derangements and synovial chondromatosis is described. The MR findings of fluid collections, increased vascularity, partial disc displacement, and changes in disc morphology and length are among those factors that influence surgical execution. Fast imaging is particularly useful in delineating fluid and vascularity changes. Synovial chondromatosis is an entity characterized by large intra-articular fluid collections and is thus ideally evaluated using MR imaging.

	The Role of Diagnostic Imaging in Dental Implantology	163
	James J. Abrahams	

Dental implants are titanium cylinders that are surgically implanted into the jaw to allow fixation of a permanent dental prosthesis. Dental computed tomographic (CT) software programs that display multiple axial, cross-sectional and panoramic images of the jaw have been developed to assess these patients preoperatively. The development and use of these programs, the implant surgical procedure, and related dental anatomy and oral pathology are discussed.

	Applications of Three-Dimensional CT Imaging in Head and Neck Pathology	181
	Charles E. Ray, Jr, Mahmood F. Mafee, Michael Friedman, and Christina N. Tahmoressi	

The advantages of three-dimensional (3-D) imaging in the diagnosis of developmental and posttraumatic craniofacial abnormalities is well established. A brief review of this role of 3-D imaging is presented, followed by a discussion of the use of 3-D imaging in various head and neck disorders.

Advanced Imaging of Osseous Maxillary Clefts

195

Philip J. Boyne, Edwin L. Christiansen, and Joseph R. Thompson

A computed tomographic (CT) technique to establish precise two-dimensional (2-D) and three-dimensional (3-D) images of the osseous defects of cleft palates is presented and illustrated by two case studies. Prospective soft tissue algorithms and bone detail imaging was made possible by a retrospective program, a specific software program and vertical reformatting technique leading to 3-D image reconstruction. The two cases illustrate the flexibility of the CT program in accurately providing morphometric and bone density data on the location and size of the osseous defects involved in the cleft. Not every cleft palate patient is a candidate for the procedures outlined; however, the diagnosis of and treatment planning for patients presenting with bilateral or extensive osseous clefting can be more accurate.

Clinical Aspects of Imaging in Maxillofacial Trauma

209

Leon A. Assael

Imaging of maxillofacial injuries serves as the principal means of qualifying the clinical diagnosis. Imaging assists in the planning of comprehensive surgical repair. In maxillofacial trauma, the key sites for imaging are the airway, mandible, midface, orbit, and frontal sinus. The use of more invasive means of providing stable fixation of facial fractures has increased the demands made on fracture imaging. Clinical decision making depends on a thorough understanding of the clinical findings in an injury and its anatomic features as delineated on images.

Preoperative and Postoperative Imaging Evaluation of Patients with Maxillofacial Deformities

221

Larry M. Wolford and Charles H. Henry

This article discusses the various imaging techniques that are most helpful in the diagnosis, treatment planning, and outcome assessment of patients with maxillofacial deformities. Specific anatomic inter-relationships of which the radiologist should be aware are discussed to aid in communication with the treating physician. Imaging characteristics of specific maxillofacial deformities and common syndromes are presented.

Index

233

Subscription Information

Inside back cover

CONTENTS

Preface

Richard P. Moser, Jr

ix

Cartilaginous Bone Tumors

M. A. Giudici, Richard P. Moser, Jr, and Mark J. Kransdorf

237

Cartilaginous tumors can be subdivided into several categories according to the following three criteria: (1) Is the lesion benign or malignant? (2) Is the lesion a pure or impure cartilaginous tumor? (3) Is the epicenter of the lesion intraosseous, juxtacortical, or in the soft tissues? This article focuses on the four most common benign cartilaginous tumors, enchondroma, osteochondroma, chondroblastoma, and chondromyxoid fibroma, and on chondrosarcoma. It reviews the biologic and developmental considerations of each and discusses in depth the basic concepts in the radiologic diagnosis of cartilaginous tumors.

Osseous Lesions

Johan L. Bloem and Herman M. Kroon

261

This article focusses on major clinical and imaging features that are of practical interest in diagnosis and management of bone forming neoplasms. Current histologic classification of these tumors is emphasized. Data presented are based on files of 1400 patients who have osseous neoplasms.

Fibrous Lesions of Bone

Terry M. Hudson, Richard G. Stiles, and David K. Monson

279

Fibrous lesions of bone include entities with a wide range of radiographic appearance and clinical behavior. Many benign fibrous lesions, such as medial supracondylar defects, fibrous cortical defects, and nonossifying fibromas have typical radiographic appearances and usually are self-limited. Desmoplastic fibromas and benign fibrous histiocytomas are less common, behave more aggressively, and usually require biopsy and surgical management. Fibrous dysplasia varies from solitary clinically unimportant lesions to wide-spread, deforming skeletal involvement that can lead to severe functional impairment and, rarely, even to death.

RADIOLOGIC CLINICS OF NORTH AMERICA

Malignant fibrous lesions, including malignant fibrous histiocytomas and fibrosarcoma, produce aggressive lytic lesions, which require careful anatomic staging, accurate biopsy, and aggressive and appropriate treatment.

Giant Cell Tumors of Bone

299

B. J. Manaster and Anthony J. Doyle

Giant cell tumors of bone usually are diagnosed easily, as they have typical radiographic characteristics that are rather specific. There is, however, considerable controversy regarding optimal treatment of these lesions, as they have a high recurrence rate when treated with the simple curettage usually accorded benign osseous lesions. This controversy is augmented by the fact that these lesions are usually found in a subarticular location, making more aggressive surgical treatment difficult. Finally, there remains the question of how useful modern imaging techniques are in predicting ultimate tumor behavior and thus influencing choice of treatment. These interesting dilemmas are further discussed in this article.

Ewing's Sarcoma

325

Kathleen Dunne Egli, Thelma Quiogue, and Richard P. Moser, Jr

Ewing's sarcoma is a small round cell tumor of bone, most commonly occurring in the lower extremity long bones of adolescents and young adults. It is histologically related to bone tumors of neural origin such as the primitive neuroectodermal tumor (PNET). The radiographic appearance is more varied than was initially understood. Magnetic resonance (MR) imaging is invaluable in defining the extent of disease. Aggressive chemotherapeutic regimens currently result in improved long-term survival, and both gadolinium-enhanced MR imaging and quantitative gallium imaging may be useful in following response to therapy.

Miscellaneous Lesions of Bone

339

William F. Conway and Curtis W. Hayes

There are several tumors and tumorlike entities of bone that do not easily fit into the specific classifications provided elsewhere in this issue. In this article, several seemingly unrelated entities are discussed, including cystic diseases of bone (simple bone cysts and aneurysmal bone cysts), Langerhans' cell histiocytosis, benign and malignant vascular tumors of bone, and adamantinoma of long bone and its relationship to osteofibrous dysplasia.

Imaging of Soft Tissue Tumors

359

Mark J. Kransdorf, James S. Jelinek, and Richard P. Moser, Jr

Magnetic resonance (MR) is the preferred modality for the evaluation of a soft tissue mass and should be obtained after (and interpreted in conjunction with) plain radiographs. The radiologic appearance of certain soft tissue tumors or tumorlike processes such as myositis ossificans, benign fatty tumors, intramuscular hemangiomas, pigmented villonodular synovitis, and certain hematomas may be sufficiently unique to allow a strong presumptive radiologic diagnosis. It must be emphasized that MR cannot reliably distinguish between benign and malignant lesions. Computed tomography may be useful in specific instances for the identification of subtle soft tissue mineralization and in those cases in which lesions are not adequately evaluated by radiographs. Sonography may be useful in the assessment of recurrent disease as well as in establishing tumor vascularity.

The Histologic Features of Musculoskeletal Tumors

Elizabeth E. Fraumenhoffer

373

An atlas of 32 captioned color photomicrographs of typical musculoskeletal tumors is presented to demonstrate the need for close radiologic and pathologic correlation of these tumors. Diagnostic and key microscopic features of these soft tissue and bone lesions are highlighted.

Magnetic Resonance Imaging of Diffuse Bone Marrow Disease

Robert M. Steiner, Donald G. Mitchell, Vijay M. Rao, and Mark E. Schweitzer

383

In this article the role of magnetic resonance (MR) imaging in the portrayal of normal and pathologic bone marrow is emphasized. Special attention is given to diffuse bone marrow disorders including depletion syndromes such as aplastic anemia, diseases of uncontrolled proliferation such as polycythemia vera, neoplasms, and the hemoglobinopathies.

Magnetic Resonance Imaging of Primary Skeletal Neoplasms

Thomas H. Berquist

411

The primary role of magnetic resonance (MR) imaging of skeletal neoplasms is that of staging. Understanding the staging process and selection of the proper imaging planes and pulse sequences is essential for proper staging. To date, image features are not specific for histologic type. In addition, there are still pitfalls with MR imaging for evaluating recurrent tumor or following therapeutic response to treatment. Dynamic gadolinium studies and spectroscopy may improve the future overall specificity for MR imaging.

Two-Dimensional and Three-Dimensional Computed Tomographic Imaging in Musculoskeletal Tumors

Donna Magid

425

Appropriate treatment of musculoskeletal neoplasms relies on prompt and accurate identification of tumor characteristics and extent. Multiplanar and three-dimensional (3-D) computed tomography (CT) provide rapid, relatively noninvasive imaging for initial assessment and for planning of radiation therapy, en bloc resection, and limb-salvage surgery. An integrated 2-D-3-D CT approach also allows precise tracking of therapeutic response and recurrence.

Index

449

Subscription Information

Inside back cover

FORTHCOMING ISSUES

- May 1993 **The Pediatric Chest**
Beverley Newman, MD, *Guest Editor*
- July 1993 **Nuclear Medicine**
R. Edward Coleman, MD, *Guest Editor*
- September 1993 **Endocrine Radiology**
Gretchen A. W. Gooding, MD, and
Charles B. Higgins, MD, *Guest Editors*
- November 1993 **Alimentary Tract Radiology**
Peter Feczko, MD, and
Duane Mezwa, MD, *Guest Editors*

RECENT ISSUES

- January 1993 **Imaging of the Paranasal Sinuses
and Oromaxillofacial Region**
Mahmood F. Mafee, MD, *Guest Editor*
- November 1992 **Occupational Lung Disease**
Theresa C. McLoud, MD, *Guest Editor*
- September 1992 **Ultrasonography of Small Parts**
Bruce Silver, MD, *Guest Editor*
- July 1992 **The Female Pelvis**
Beverly G. Coleman, MD, *Guest Editor*

CONTENTS

Preface

Beverley Newman

xi

Pediatric HIV Infection in its Second Decade—The Changing Pattern of Lung Involvement: Clinical, Plain Film, and Computed Tomographic Findings

Walter E. Berdon, Robert B. Mellins, Sara J. Abramson, and Carrie Ruzal-Shapiro

453

The changing pattern of pediatric HIV infection is illustrated in this article with plain films and computed tomographic scans. Today, vertical transmission from infected mothers results in HIV infection of exposed infants in about one third of pregnancies. Although the high mortality with catastrophic illnesses such as *Pneumocystis carinii* pneumonia seen in early life appears to be decreasing, chronic illness with pulmonary involvement due to diffuse lymphocytic infiltrative syndromes continues. Lymphocytic interstitial pneumonitis (LIP) has evolved in some patients to cystic lung disease and bronchiectasis. There are increasing numbers of patients infected with *Mycobacterium*. Masses seemingly of smooth muscle origin, thought to be leiomyomasarcoma are appearing; they may be pseudotumors related to concomitant *Mycobacterium avium intracellulare* infection.

Transplantation and the Pediatric Chest

Jocylene Ledesma-Medina, Michael Green, and Beverley Newman

465

The plain chest radiograph is the mainstay in the imaging assessment of the chest in a prospective organ recipient and is invaluable in the initial evaluation of posttransplant complications. Although the presence of focal or diffuse air-space disease on a chest radiograph is often nonspecific, this finding helps direct the choice of other diagnostic methods. Among cross-sectional imaging techniques, computed tomography is used most often to further define anatomy and abnormal findings and to guide needle biopsy or aspiration if necessary. A variety of posttransplant complications are discussed, including common postoperative findings, pulmonary infection, and organ rejection.

Nuclear Medicine in the Pediatric Chest

G.N. Larar, L.A. O'Tuama, and S.T. Treves

481

Nuclear medicine enables functional evaluation of organ systems not possible with standard anatomic imaging modalities. The pathophysiology necessitating scintigraphic examination of the pediatric patient is often different from that in the adult and therefore calls for new or modified applications of nuclear medicine. This article briefly reviews such application, with the scope limited to the evaluation of the pediatric chest and organ systems.

Perinatal and Postnatal Chest Sonography

David A. May, Richard A. Barth, Scott Yeager,
Anna Nussbaum-Black, and Dorothy I. Bulas

499

Sonography is the primary method used to image the fetal chest. Many significant congenital anomalies such as pleural effusion, congenital diaphragmatic hernia, cystic adenomatoid malformation, pulmonary sequestration, and congenital heart disease can be detected during early prenatal sonography. Fetal sonography also permits accurate assessment of the severity of these processes, allowing for parental counseling and optimal planning of postnatal care. After birth, sonography is the primary method for evaluating cardiac anatomy and diagnosing congenital heart disease. Sonography also serves as a useful adjunct to plain film radiology and other modalities in evaluation of the mediastinum, diaphragm, pleura, and chest wall.

Sonography of the Chest in Children

Tamar E. Ben-Ami, Julie C. O'Donovan, and David K. Yousefzadeh

517

Sonography of the chest in children should follow the plain radiograph in the evaluation of anterior and middle mediastinal masses, opaque chest, pleural and peripheral lung lesion, and juxtadiaphragmatic lesions. It also helps clarify some perplexing chest radiographs. Sonography is sometimes the only feasible modality in children who have presented to the emergency department in respiratory compromise or in those with respiratory compromise who are already in the intensive care unit. It is superior to all other modalities in tissue and fluid characterization, and it may guide fluid aspiration and biopsies. Spectral and color flow Doppler facilitate anatomic differentiation of pulmonary from pleural mediastinal and chest wall lesions and improves tissue characterization.

High-Resolution Computed Tomography of Pediatric Pulmonary Parenchymal Disorders

Jerald P. Kuhn

533

High-resolution computed tomography (HRCT) has not been used widely for the pediatric lung. This article describes optimal techniques in normal appearances in childhood. The HRCT appearances of airway, air-space, interstitial, and vascular diseases of the lung are described.

Magnetic Resonance of Congenital Cardiovascular Disease: An Update

Estelle R. Bank

553

Magnetic resonance (MR) has become an important tool in the evaluation of the child who has congenital heart disease. Current techniques and applications of MR in the evaluation of great vessels, vascular causes of airway obstruction, and the postoperative patient are discussed.

Telltale Signs of Congenital Heart Disease

John J. Crowley, Kook Sang Oh, Beverley Newman,
and Jocylene Ledesma-Medina

573

There are several key plain film findings that raise suspicion for and aid in the differentiation of congenital heart defects. These 'telltale' signs and their significance and the additional necessary imaging studies of cardiac lesions are discussed with particular emphasis on the role of magnetic resonance imaging.

Imaging of Mediastinal Masses in Children

Manuel P. Meza, Marilee Benson, and Thomas L. Slovis

583

Conventional radiographs show the mediastinum to be the most frequent location of thoracic masses in children. The compartmental approach to evaluation of pediatric mediastinal masses is advised. Compartmental localization and lesion internal characteristics are best determined by cross-sectional imaging techniques. These techniques as well as the causes and significance of the common pediatric mediastinal masses are discussed. Imaging of the thymus is emphasized because normal thymic tissue can mimic pathologic conditions and the thymus is a common thoracic location for neoplasms in children.

Diseases of the Trachea, Bronchi, and Smaller Airways

N. Thorne Griscom

605

The tubes that carry oxygen to the alveoli and carbon dioxide back out again are vulnerable to a variety of insults. These insults usually cause narrowing of those tubes and, if allowed to progress, frequently threaten death by suffocation. Among the inflammatory airway illnesses of childhood are croup and bronchiolitis. Tumorous processes include papillomas and mediastinal masses. Congenital malformations such as tracheoesophageal fistula and pulmonary artery sling, although less common, often need to be considered when a child develops signs or symptoms of an abnormality of the trachea, bronchi, or smaller airways.

Cystic Fibrosis: Clinical Update for Radiologists

David M. Orenstein and A'Delbert Bowen

617

The clinical features and current management of cystic fibrosis are reviewed, with emphasis on pulmonary manifestations. Pulmonary radiographic findings in cystic fibrosis are illustrated. The role of transplantation as a therapeutic avenue is discussed. Recent discoveries—the specific genetic mutation in cystic fibrosis, the elucidation of the cellular defect, and the development of gene-transfer techniques to correct the cellular defect *in vitro*—have generated fresh excitement in the search for an ultimate cure for cystic fibrosis.

Cysts and Cystlike Lesions of the Lung

Marta Hernanz-Schulman

631

This article reviews the major pulmonary cystic lesions that occur in infants and children. Using the framework of an age-dependent algorithm, pulmonary cysts are analyzed within the broader scope of their pathologic finding while emphasizing their imaging characteristics and their differential diagnosis.

Nodules, Masses, and Pseudomasses in the Pediatric Lung

Kathleen Dunne Egli and Beverley Newman

651

Parenchymal pulmonary masses are distinctly uncommon in the pediatric patient, occurring less frequently in this age group than mediastinal

masses. When present, they are far less likely to represent malignancy, either primary or metastatic, than similar lesions in the adult population. A host of benign lesions, many specific to children, make up the great part of the differential diagnosis. This article reviews these pulmonary masses.

The Newborn Chest

Beverly P. Wood

667

Newer therapeutic techniques in the respiratory management of preterm and full-term neonates have resulted in improved survival, particularly in those infants who have respiratory distress syndrome, severe pneumonia, and surgical lesions of the chest. Although respiratory distress syndrome is being seen less frequently because of improved ventilatory management and the use of surfactant replacement therapy, the increased survival of preterm infants has resulted in an increased incidence of bronchopulmonary dysplasia, still a frequently seen pulmonary abnormality. Children who have severe pulmonary disease related to diaphragmatic hernia, meconium aspiration pneumonia, and infectious pneumonia are treated with extracorporeal membrane oxygenation, resulting in a higher survival rate and better outcome. Other abnormalities of the lung, including pneumonia, are seen in both preterm and full-term infants, have characteristic radiographic appearances, and require prompt antibiotic treatment.

Radiology, Surgery, and the Pediatric Chest

George A. Taylor and Jane E. Benson

677

This article reviews the role of conventional radiography and the newer cross-sectional techniques in the initial diagnosis and postoperative surveillance of surgical diseases of the pediatric chest. Specific goals for preoperative evaluation of abnormalities of the tracheobronchial tree, chest wall and diaphragm, the mediastinum, and pulmonary parenchyma are reviewed from a surgical perspective. Finally, integrated approaches to the imaging of postoperative complications are discussed.

Intervention in the Thorax in Children

Robin D. Kaye, Ronald G. Grifka, and Richard Towbin

693

The 1970s and 1980s have been a period of significant growth and innovation in interventional radiology. Interventional procedures that were developed and perfected with adult patients are now being used very successfully in pediatric patients. In comparison with surgical management, interventional procedures generally have lower morbidity and mortality, require shorter hospital stays, and are less expensive. Preprocedural imaging and planning, adequate monitoring and sedation during the procedure, and selection of equipment appropriate for pediatric patients maximizes the chance for a successful outcome.

Index

713

Subscription Information

Inside back cover

CONTENTS

Preface

xi

Technical Aspects of Bone Scintigraphy

721

Manuel L. Brown, Michael K. O'Connor, Joseph C. Hung,
and R.J. Hayostek

The radionuclide bone scan is an important method for the initial staging and follow-up evaluation of patients with soft tissue malignancies and primary bone tumors. This article reviews the common scintigraphic findings in benign bone tumors, discusses the patterns associated with malignant tumors, and describes the efficacy of bone scintigraphy in the more common malignancies such as prostate cancer and breast carcinoma.

Bone Scintigraphy in Benign and Malignant Tumors

731

Manuel L. Brown

Bone scintigraphy is frequently performed in most radiology departments and is an excellent technique for evaluating both oncologic and benign disease processes. Careful attention to the technical aspects of bone scintigraphy as described in this article results in images of excellent quality.

Bone Scintigraphy in Skeletal Trauma

739

Lawrence E. Holder

This article emphasizes the usefulness of radionuclide bone imaging (RNBI) throughout the clinical spectrum of osseous trauma and relates RNBI to the other imaging modalities available. Acute, stress, insufficiency, avulsion, and occult fracture detection are discussed and illustrated. Other traumatic lesions including the bone bruise, shin splints, tendinitis and epiphyseal injuries are included. Biomechanical lesions, the result of more chronic low level repetitive stress are discussed in detail, as is the use of RNBI in the detection of post-traumatic sequela such as the reflex sympathetic dystrophy syndrome. Technical aspects of RNBI are considered in the context of producing the quality of diagnostic images necessary for clinically complete consultative reporting.

Radionuclide Imaging in the Evaluation of Infections and Inflammatory Disease

Naomi P. Alazraki

783

Radionuclide imaging of suspected soft-tissue inflammatory disease is usually performed with Ga-67 citrate or In-111 leukocytes. Each agent has advantages and disadvantages. Although In-111 leukocyte imaging is quite effective in imaging inflammatory processes, the handling of blood limits the use of this procedure. In patients with focal signs or symptoms, CT is the preferred imaging technique. In-111 leukocyte imaging has a high sensitivity and specificity for detecting abdominal and pelvic infections. Gallium-67 citrate is particularly effective in evaluating suspected pulmonary inflammatory processes and in evaluating patients with fever of undetermined origin. In the evaluation of osteomyelitis, the three- or four-phase bone scan should be the first radionuclide imaging study, and, if its result is inconclusive, In-111 leukocyte imaging should be performed. New inflammatory imaging agents such as In-111 labeled nonspecific immunoglobulin are likely to be more widely used in the future.

Myocardial Perfusion Imaging Using Technetium-99m Radiopharmaceuticals

Hosen Kiat, Daniel S. Berman, and Jamshid Maddahi

795

Research and development in nuclear cardiology have made major contributions to the noninvasive approach for detection of coronary artery disease, to the assessment of disease extent and severity, and for prognostication of cardiac events. This article discusses the use of myocardial perfusion imaging and describes techniques for the evaluation of myocardial viability.

Radionuclide Ventricular Function Analysis

Salvador Borges-Neto and R. Edward Coleman

817

Ventricular function analysis provides diagnostic and prognostic information. The radionuclide techniques used for performing ventricular function studies are the first-pass radionuclide angiogram and equilibrium radionuclide angiography. Each of these techniques provides the accurate determination of ejection fraction at rest and during exercise. The equilibrium technique permits a better evaluation of wall motion because the ventricle is able to be imaged in multiple projections. Ventricular function and myocardial perfusion can now be determined with the single administration of a radiotracer, and the combined information provides more diagnostic information than either parameter alone.

Diagnosis of Renovascular Hypertension with ACE Inhibition Scintigraphy

George N. Sfakianakis, Jacques J. Bourgoignie, Michalakos Georgiou, and Jorge J. Guerra, Jr

831

Curable renovascular hypertension from severe renal artery stenosis (>60-70% of the lumen) may be diagnosed reliably and efficiently with baseline and post-intravenous enalaprilat (ACE inhibition) renography using a tubular agent ($^{99m}\text{Tc-MAG}_3$) with the aid of furosemide.

Role of Radionuclide Imaging in Patients with Suspected Pulmonary Embolism

Daniel F. Worsley, Abass Alavi, and Harold I. Palevsky

849

The accurate diagnosis of acute pulmonary embolism often represents a challenge to clinicians. The ventilation/perfusion (V/Q) lung scan provides

783 a safe, noninvasive technique, which has been widely used in the diagnosis of pulmonary embolism. Although some controversy still exists in the management of patients with suspected pulmonary embolism, diagnostic strategies for investigating patients have incorporated V/Q scanning, noninvasive venous studies of the lower extremities and clinical assessment of the likelihood of pulmonary embolism. The combination of these strategies will provide acceptable diagnostic accuracy for evaluating patients with suspected pulmonary embolism in the majority of cases.

Tumor Imaging and Therapy

Andrew M. Scott and Steven M. Larson

859

Oncology applications in nuclear medicine include both the staging of tumors, e.g., bone scanning, and monitoring response to therapy with tumor-specific radionuclides such as ^{67}Ga -citrate and ^{201}Tl -chloride. An increasing role for positron emission tomography and monoclonal antibody studies in oncology is emerging, and therapeutic applications in thyroid cancer and in the treatment of metastatic bone pain are achieving impressive results. This area is likely to become the fastest growing component of nuclear medicine practice over the next decade.

SPECT Brain Imaging in Neurologic Disease

Ronald L. Van Heertum, Scott H. Miller, and Roger E. Mosesson

881

17 In recent years cerebral SPECT imaging is rapidly evolving as a clinical tool in the evaluation of a variety of neurologic disorders. In large part, the major advances in brain imaging which have occurred in the last four years are related to new developments in instrumentation and radiopharmaceuticals. In particular, the increased availability of multidetector and dedicated ring detector systems has given rise to improved image resolution and more rapid patient throughput. Advances in the field of radiopharmaceutical development, particularly as it pertains to perfusion brain SPECT agents, has also contributed to the advances in the field. As a result of these developments, there has been an expanded interest in and use of brain SPECT imaging procedures in the evaluation of cerebrovascular disease, dementia, epilepsy, and head trauma.

Radionuclides in Endocrine Imaging

Martin P. Sandler and Dominique Delbeke

909

1 Radiopharmaceuticals used in endocrine imaging encompass both standard and recently developed techniques used to diagnose diseases of the endocrine system. The initial part of this article deals with the characteristics of a suitable radionuclide/radiopharmaceutical required for successful scintigraphic endocrine imaging. The remainder of the article includes clinical applications and practical uses of developed scintigraphic agents in diagnosing disorders of the various endocrine glands. Finally, there is reference to the new and exciting neuropeptide imaging agent Octreoscan 111.

Nuclear Hepatobiliary Imaging

E. Edmund Kim, Tae-Yong Moon, Ebrahim S. Delpassand, Donald A. Podoloff, and Thomas P. Haynie

923

Recent improvements in hepatobiliary radiopharmaceuticals and the high prevalence of biliary tract disease have resulted in a larger role for hepatobiliary imaging in clinical applications. The use of hepatobiliary imaging in assessing hepatic blood flow, hepatocyte function, biliary drainage, and complications in patients with jaundice or abdominal pain

or surgery, as well as its primary use in diagnosing acute cholecystitis, is discussed.

Clinical Positron Emission Tomography Imaging

935

John M. Hoffman, Michael W. Hanson, and R. Edward Coleman

Positron emission tomography (PET) is assuming increasing importance as an imaging modality in evaluation of neurologic, oncologic, and cardiac disease. Its unique ability to provide cross-sectional physiologic information makes it very useful in the evaluation of human disease in which structural anatomy remains unchanged but the metabolism or function of the tissue is affected by the disease process. We provide an overview of the present status of clinical PET in the United States.

Index

961

Subscription Information

Inside back cover

CONTENTS

Preface

Gretchen A. W. Gooding and Charles B. Higgins

xi

Sonography of the Thyroid and Parathyroid

Gretchen A. W. Gooding

967

Ultrasound is a primary imaging tool for thyroid and parathyroid localization. Classic thyroid and parathyroid tumors are easily distinguished by their sonographic appearance and location, but variations are common and complicate the distinction. Thus, biopsy under ultrasound guidance provides proof of the nature of the lesion. When parathyroid localization is problematic with ultrasound, magnetic resonance imaging is an excellent alternative.

Radioisotopic Evaluation of the Thyroid and the Parathyroids

David C. Price

991

Since the inception of the discipline of nuclear medicine, thyroid evaluation and therapy with radioactive isotopes have remained an important and constant component of thyroidology. Parathyroid scintigraphy with $^{201}\text{Tl}/^{99\text{m}}\text{Tc}$ subtraction has been a more recent and also very useful addition in the assessment of hyperparathyroidism, particularly at reoperation. The radioactive iodine uptake test gives important metabolic information on thyroid function in such diverse disease states as hyperthyroidism, hypothyroidism, the thyroiditides, and thyroid carcinoma. Thyroid scintigraphy is also a key contributor to the assessment of patients with hyperthyroidism or with single versus multiple thyroid nodules, those with a history of head and neck irradiation during childhood, and those requiring diagnostic follow-up studies with ^{131}I after total thyroidectomy for differentiated thyroid carcinoma. Each of these topics is reviewed and expanded on in this article, with a diversity of illustrative scans provided to complement the discussion.

Role of Magnetic Resonance Imaging in Hyperparathyroidism

Charles B. Higgins

1017

Magnetic resonance imaging is indicated for the localization of the abnormal gland or glands in patients with recurrent or persistent hyperparathy-

roidism. The accuracy of MRI is equivalent or superior to thallium subtraction scans and high-resolution ultrasonography for identifying the abnormal glands in the neck and superior to other noninvasive imaging techniques for recognizing ectopic glands in the thorax. Most glands have low to medium intensity on T1-weighted images and high intensity on T2-weighted images; however, glands with unusual signal intensity characteristics occur infrequently. Abnormal glands have shown considerable enhancement on T1-weighted images after use of gadolinium DTPA. Some pitfalls in the identification of abnormal parathyroid glands are now recognized.

Practical Considerations in the Scintigraphic Evaluation of Endocrine Hypertension: The Adrenal Cortex and Medulla

Robert S. Hattner

1029

Evaluation of endocrine hypertension from functional adrenal lesions when biochemical findings conflict with those from CT scans or MR images or when these methods fail can be vexing. Therapeutic strategies for these disorders span a broad spectrum, and the endocrinologist and surgeon need a specific diagnosis. In these circumstances, NP-59 adrenocortical and MIBG adrenomedullary scintigraphic studies almost always provide the answer.

The Dilemma of Bilateral Adrenocortical Nodularity in Conn's and Cushing's Syndromes

John L. Doppman

1039

Bilateral adrenal nodularity in Conn's and Cushing's syndromes leads to a more complex differential diagnosis than the presence of a unilateral mass or bilateral hyperplasia. In Conn's syndrome, bilateral nodularity is not synonymous with hyperplasia, and adrenal venous sampling is required to detect those cases of surgically correctable aldosteronoma. In Cushing's syndrome, bilateral nodularity can result from an ACTH-dependent or an autonomous cause of hypercortisolemia. The appropriate therapeutic decisions depend on the recognition of these different entities.

Endocrine Angiography and Venous Sampling

Donald L. Miller

1051

Invasive vascular procedures may be essential to locate a small hyperfunctioning endocrine tumor prior to surgery or to distinguish between disease due to a solitary tumor and disease due to diffuse hyperplasia. These procedures require a detailed knowledge of vascular anatomy and must be performed meticulously to avoid errors.

Adrenal, Pancreatic, and Scrotal Ultrasound in Endocrine Disease

Gretchen A. W. Gooding

1069

Ultrasound is an ancillary tool in adrenal imaging in adults and a primary tool in children. Intraoperative sonography is the method of choice for pancreatic endocrine tumors. In the scrotum, the benign adrenal rest tumors must be distinguished from the more common malignant mass.

Pancreatic Imaging: Computed Tomography and Magnetic Resonance Imaging

Ruedi F. Thoeni and Francis Blankenberg

1085

For imaging of pancreatitis, CT is highly sensitive for detecting and accurate for staging of both pancreatitis and pancreatic carcinoma. For the diagnosis of small islet cell tumors, MR imaging offers a definite advantage

because it provides excellent liver-tumor contrast; at present, however, it offers no advantage over CT for assessing patients with pancreatitis and pancreatic carcinoma. The recent development of high-speed CT scanners has reconfirmed CT as the method of choice in the evaluation of pancreatic disease, because of its superb image resolution and outstanding definition of vasculature.

The Ovary: Computed Tomography and Magnetic Resonance Imaging

1115

Kathryn A. Occhipinti, Steven D. Frankel, and Hedvig Hricak

CT and MR imaging can provide essential information for the evaluation of both benign and malignant ovarian lesions. Characterization of ovarian cysts, benign tumors, and ovarian carcinoma, as well as preoperative assessment of patients with disorders of sexual differentiation, is facilitated when CT or MR imaging is performed.

Radiologic Diagnosis of Osteoporosis: Current Methods and Perspectives

1133

Stephan Grampp, Michael Jergas, Claus C. Glüer, Philipp Lang, Peter Brastow, and Harry K. Genant

Osteoporosis is defined as a decrease in bone mass accompanied by structural changes, leading to an increase in fracture propensity. Early diagnosis of osteoporosis, fracture risk prediction, and assessment of efficacy of therapy therefore are of great interest. A number of noninvasive techniques are available for measuring bone mass at multiple sites of the skeleton. This article reviews basic methodology and developments in radiology such as x-ray and photon absorptiometry and quantitative computed tomography, which are routinely used in clinical practice. Recent techniques for assessment of bone mineral density and structure, such as ultrasound measurements, and their possible clinical applications also are discussed.

Hypothalamic and Pituitary Pathology

1147

Brian W. Chong and T. Hans Newton

This article details the intricate anatomy and elegant physiology of the hypothalamic-pituitary axis. The discussion is meant to confer an understanding of the principles of neuroendocrinology appropriate for the radiologist interpreting imaging studies of this region. The clinical presentations of the diseases that occur in this area of the central nervous system are unique and therefore are discussed in some detail. The radiologic features of the diseases affecting the hypothalamic-pituitary axis are described and correlated with the relevant pathology.

Index

1185

Subscription Information

Inside back cover

TH

C

Pro
Pe

Se
Jo

Is
Fr

R
G

V

CONTENTS

Preface

Peter J. Feczko and Duane G. Mezwa

ix

Screening for Colon Cancer: Controversies and Recommendations

Joseph T. Ferrucci

1189

Colorectal cancer is the second most common cause of overall cancer mortality in the United States. This article reviews pertinent clinical and policy issues, details current colorectal cancer screening concepts, summarizes American College of Radiology achievements to date, and outlines projects in the next phase of the effort.

Ischemic Bowel Disease

Francis J. Scholz

1197

The pathophysiologic events occurring in the ischemic process are described so that radiologic findings are understood rather than memorized. Depending on the underlying disease, the ischemic process can lead almost instantly to infarction or may be so indolent that years or even decades of low-grade ischemia may occur. The spectrum is discussed and illustrated.

Radiologic Evaluation of Suspected Gastrointestinal Perforations

Gary G. Ghahremani

1219

Perforation of the alimentary tract may occur spontaneously in various gastrointestinal diseases or develop due to an ingested foreign body, iatrogenic complication, and blunt or penetrating injuries. The detection of extraluminal air on radiographs of the chest or abdomen is often the initial clue to the diagnosis. It may not, however, be visible when the perforation is small, rapidly sealed, or well contained. Further evaluation by special radiographic techniques, gastrointestinal studies using contrast media, or CT examination can demonstrate the site and nature of the perforation. This article reviews the clinical features and methods for radiologic assessment of suspected perforations involving the upper gastrointestinal tract, small bowel, or colon and rectum.

Appearances of the Postoperative Alimentary Tract

1235

Claire Smith, Daniel J. Deziel, and Robert A. Kubicka

Operations on the gastrointestinal tract can alter the normal as well as pathologic appearances. Any radiologist performing studies on patients who have had gastrointestinal tract surgery must be confident in identifying both normal and abnormal postoperative anatomy, as well as be knowledgeable about the methods to obtain a diagnostic study. This article reviews the basic operations performed on the gastrointestinal tract, discusses a rationale of the surgical procedure, provides a logical approach to contrast study of postoperative patients, and illustrates normal appearances and common complications.

Imaging of Recurrent Carcinoma of the Gastrointestinal Tract

1255

Stephen W. Trenkner and William M. Thompson

CT scanning is currently the main imaging modality used to detect recurrent cancer of the gastrointestinal tract. Additional studies such as MR imaging, ultrasound, and immunoscintigraphy provide complementary information. Further research is needed so that these studies can be applied in a cost-effective manner that has a positive impact on clinical outcomes.

Contrast Evaluation of the Pharynx and Esophagus

1265

V.H.S. Low and S.E. Rubesin

Swallowing requires the coordinated action of the alimentary tract from the oral cavity to the gastroesophageal junction. Any structural or functional abnormality along this pathway will interfere with swallowing. The "barium swallow" or pharyngoesophagogram requires examination of the oral cavity, pharynx, esophagus, and gastric cardia.

Role of the Barium Enema in Colorectal Carcinoma

1293

David J. Ott

Colorectal carcinoma is the second most common cancer that occurs in women and men. To better appreciate the role of the barium enema in the evaluation of colorectal carcinoma, an understanding of its epidemiology, pathologic development, and current methods of detection is needed. Following review of these aspects of colorectal carcinoma, the barium enema is discussed more thoroughly regarding examination techniques, radiologic evaluation of colonic neoplasms, quality of the examinations, and radiologic efficacy.

Inflammatory Conditions of the Stomach and Duodenum

1315

Joel E. Lichtenstein

Gastroduodenal inflammatory conditions are exceedingly common and have a wide spectrum of causes and manifestations. Concepts of the pathophysiology of gastritis, duodenitis, and ulcers continue to evolve. The inter-relationships of acid production, immunity, chemical and physical agents, and infection are still being clarified. Effects of medication, surgery, and immunocompromised states all contribute to the ongoing challenge that this group of important conditions presents to the modern radiologist.

The Abdominal Plain Film: What Will Be Its Role in the Future?

1335

Stephen R. Baker

Conventional imaging studies are now being closely scrutinized for clinical utility. Some, like the skull film, are obsolete while others have secured an enduring place for themselves. The plain film of the abdomen occupies a

middle ground with its role supplanted by other studies for many conditions but its value is still appreciated for the assessment of intestinal obstruction and perforation. Today, its special capabilities for the evaluation in diverticulitis and iron therapy have been under emphasized. In the future, the plain film will have a narrower focus but when combined with CT both examinations can be enhanced.

Abdominal Complications in Organ Transplant Recipients

1345

Robert D. Halpert, Philip Goodman, and Dina F. Caroline

A variety of intra-abdominal complications are associated with organ transplantation. These include inflammatory changes involving the bowel, liver, and pancreas. These range from technical complications associated with the surgery to the organ rejection, opportunistic infections, and an increased risk of de novo malignancy in transplantation patients.

Metastatic Disease Involving the Gastrointestinal Tract

1359

Peter J. Feczko, Denise D. Collins, and Duane G. Mezwa

Metastatic involvement of the gastrointestinal tract is increasing in frequency as survival times for patients with cancer improve. Knowledge of the pathways of spread of malignancy will aid in the diagnosis of these lesions.

Radiologic Evaluation of Constipation and Anorectal Disorders

1375

Duane G. Mezwa, Peter J. Feczko, and Carol Bosanko

Over 4 million people in the United States have frequent constipation, a prevalence of about 2%. Once the condition is diagnosed, radiology can often play a critical role in determining not only the etiology of the disease but also the therapeutic planning. The studies described in this article are simple to perform and often add tremendously to the care of some very difficult patients.

Practical Approaches to Pediatric Gastrointestinal Radiology

1395

David F. Merten

Radiologic evaluation of the pediatric gastrointestinal tract requires knowledge of the specific problems acutely afflicting the gastrointestinal tract in children and the specialized approaches required for accurate radiologic diagnosis. Efficacious radiologic evaluation and accurate diagnosis are possible only when the radiologist is aware of the presence and significance of clinical findings. The radiologist must take an active role in formulating a presumptive diagnosis and determining the best course of radiologic examination. Careful correlation of clinical and radiologic findings is necessary to assure accurate diagnosis and appropriate treatment.

Cumulative Index 1993

1409

Subscription Information

Inside back cover